

REMARKS

The Examiner has rejected claims 1-3, 6-7, 12-13, 16-17 and 19-20 under 35 U.S.C. 103(a) as being unpatentable over what the Examiner referred to as Applicant's admission as prior art (Fig. 1) in view of Gielen U.S. Patent No. 5,771,050 ("*Gielen*"). Applicant respectfully traverses the rejection

As Applicant points out below, the combination cited by the Examiner still leaves some elements of each of the claims that are not suggested anywhere in the combination. These differences in the claimed invention over the cited art have advantages over the prior art and, Applicant submits, are not obvious. This is particularly important with respect to certain dependent claims. While the prior art applied by the Examiner does provide a way of making corrections for substrate feed error with printhead manipulation, it does so without knowing what the error is, so it cannot make adjustments that reduce error going forward. The present invention does so in a different way, rather in a way that better handles cumulative, repeated or large error. The cited *Gielen* reference can, in some embodiments, reach a limit at which cumulative error will mount and exceed the range over which the device will correct, while in other embodiments, the error will continually repeat. Further, out of range errors in the *Gielen* device can never be corrected. Additionally, the present invention employs different structure than the *Gielen* reference and applies its correction in a different way than does the *Gielen* device. Applicant requests reconsideration and withdrawal of the rejection for these reasons, as more fully set forth below.

Applicant further requests that the Examiner grant an interview when this response comes up for consideration to facilitate mutual understanding of the claims and art of record, and to deal with any amendments that might be found necessary, if any, to place the application in condition for allowance or appeal.

Claim 1 claims a method of indexing a substrate relative to a printhead between printing consecutive transverse scans of the printhead in the printing of an image on the substrate. The *Gielen* reference has a roughly similar objective. But the claimed method comprises the step of indexing the substrate to move the substrate longitudinally an incremental distance followed by the step of measuring the actual distance moved by the substrate during the indexing. The present

invention also claims the step of determining from the measuring the difference between the actual distance the substrate was to move during the indexing step. So the control of the present invention has actual knowledge of the actual distance that the substrate was moved and how much that distance deviated from the incremental distance that the substrate was to be moved by the indexing. Finally, the method adjusts the longitudinal position of the printhead in response to the determined difference.

In contrast, the *Gielen* reference advances the substrate on the machine, but at no time possesses the information of how much the substrate was actually moved. It merely hunts for the location of a printed registration mark. Then it selects print head nozzles to roughly set the print position to print the next row in relation to the located registration mark. Lastly, it extends the print head mounting linkage to finely position the selected print head rows to print the next row in a desired position relative to the registration mark.

In the *Gielen* device, when a new row is printed with the selected nozzles in their extended position, another registration mark is also printed. So the next feed step advances the substrate from the previous position that was displaced by the amount of the previous feed error from its ideal position that would have centered the print area under the rest position of the print head. So if error occurs in the same direction in the next feed cycle, the row selection could (depending on the way that the substrate feed is controlled) have to shift further in the same direction as before and the print head extension could have to extend even further, eventually reaching a limit of travel, with no further ability to correct. Alternatively, (if the paper feed is controlled by sensing the registration mark) the same correction will have to be made with each printing scan. If the feed error is larger than the fine print head adjustment can handle, the error could never be corrected.

The present invention is able to use the additional information it acquires to adjust the future indexing step to take into account the amount of correction already imposed. This allows the print head to move back toward its neutral or rest position. Cumulative error can be compensated for in this way, and recurring error can be eliminated. Large errors that cannot be corrected in one scan will eventually be corrected, too. This future indexing adjustment that achieves these advantages is specifically claimed in claims 13, 4 and 8.

The claimed differences in both the structure of the invention over the prior art and its method can be seen more clearly by comparing more closely the present specification with the disclosure of the *Gielen* reference.

Firstly, it should be noted that the examiner says (Office Action, page 3) that the Applicant's admitted prior art (AAPA, Fig. 1, specification paragraph 17) discloses "a motion system configured to move the printhead longitudinally relative to the frame." But, as can be seen in figure 1, the servo 21 moves the carriage 18 transversely across the bridge 17. The Examiner also says (Office Action, page 3) that the system disclosed in *Gielen* includes "a means for detecting a deviation/difference/less in the advance amount and the correct amount" (Office Action, page 4). This is not correct. The system of *Gielen* detects a registration mark only (Col. 5, lines 35-52) and alters the position of the print head relative to the registration mark.

In *Gielen*, registration marks are specifically printed so that, at each successive print scan, the longitudinal position of the print-head can be aligned with the longitudinal position of the preceding print scan. It is true that the system of *Gielen* is capable of compensating for substrate feed errors, as mentioned at Col. 5, lines 35-52. But the system does this without any knowledge of the actual advance amount, or of the intended advance amount. It also has no knowledge of the position of the substrate relative to the frame or to the carriage. The only information it possesses is the position of the print head relative to the reference mark. So *Gielen* does not perform the measuring step recited in the claims and has no ability to perform the determining step as recited in the claims.

In the *Gielen* system, the sensor 36 is mounted on the print head 12 (see figures 1-3 of *Gielen*). It follows that the sensor is therefore only capable of detecting the position of the reference mark which was printed during the previous print scan and adjusting the print position relative to the reference mark. In order to calculate the actual distance moved by the substrate between one scan and the next, two extra items of information would be required, namely the relative displacement between the print head and the carriage at the time the reference mark was printed, and the relative displacement between the print-head and the carriage at the time the reference mark was detected. *Gielen* does not mention the recording or use of either of these items

of information. And there would be no reason to collect or use this information, since the system works in its intended manner without it.

By measuring the actual advance of the substrate, the present invention eliminates the need for printing a reference mark. It also has other advantages: the controller has prior knowledge of the intended amount of substrate advance, and it receives the actual amount of substrate advance directly from the web sensor, so the compensation displacement information can be available immediately (even while the substrate is still moving, for example). As a result, the next indexing step can be adjusted to avoid accumulation of error and out-of-range movement of the print head on the machine.

In the *Gielen* system, the sensor must first wait until the substrate has stopped moving, then it must detect the reference mark. The *Gielen* system also requires the printing of reference marks and, therefore, requires extra nozzles, extra ink, extra time, and extra control arrangements. It also requires the printing of unnecessary and possibly unsightly marks on the substrate. The present invention does not require the use of reference marks.

From the above it can be seen that Applicant is not broadly claiming the use of print head position adjustment to compensate for substrate feed error. Rather, Applicant is claiming a new and unobvious method of doing so that differs from the methods of the prior art and provides advantages that the prior art does not provide.

For the reasons stated above, it is submitted that the cited art does not teach one skilled in the art to employ the invention or how to employ the invention. The rejection, therefore, fails to present a *prima facie*, case for the obviousness of what Applicant has claimed. Accordingly, reconsideration and withdrawal of the rejection and allowance of the application are respectfully requested.

Application No. 10/597,546
Amendment dated October 13, 2010, in Response to
Office Action mailed July 13, 2010

Applicants are of the opinion that no fee is due as a result of this Amendment. If any additional charges or credits are necessary to complete this communication, please apply them to Deposit Account No. 23-3000.

Respectfully submitted,
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